

Ball/Shuttlecock Tracking

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ACASVA Project Meeting
January 13, 2011
University of East Anglia, London

Tennis ball Tracking strategy

- Tennis ball trajectory crucial for tennis analysis
- Input: a play shot.
- Output: ball position(s) in each frame
- A three-level tracking strategy:
 - Candidate detection with image processing
 - Tracklet generation using RANSAC-like algorithm
 - Path level association with graph formulation

From singles tennis game to doubles

- Tracking in singles is challenging already:
 - Small size, high velocity
 - motion deformation, motion blur
 - Abrupt motion change
 - Occlusion
 - Camera motion, lack of 3D information
- Tracking in doubles is even more difficult:
 - More occlusion and more abrupt motion change

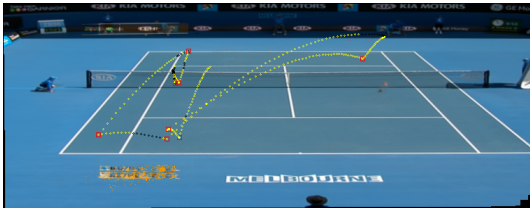
From singles tennis game to doubles

- Improved tracklet generation algorithm for doubles game
- Tracklet generation: optimisation problem in the space of motion parameters
- The old tracker: RANSAC with hill-climbing
 - Efficient, but may converge to local optima
- Solution: RANSAC with randomised optimisation
- Increased robustness in doubles game:
 - $\sim 70\%$ precision and recall in key event detection

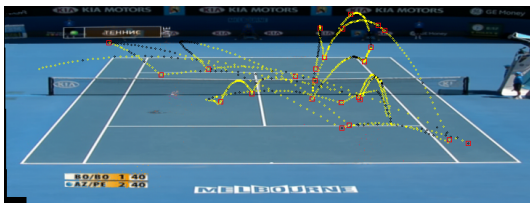
Tennis ball Tracking strategy
From singles tennis game to doubles
Early information fusion
From tennis to badminton
Future work

Early information fusion

Early information fusion



Early information fusion



- Example one: ball trajectory split where shouldn't
- Example two: ball trajectory not split where should
- Reason: lack of high level contextual information

Early information fusion

- Ball tracker works without knowledge of player/audio
- Hard decision made before fusion
- Solution: early fusion instead of late fusion
- Recall the three-level tracking strategy: candidate level, tracklet level, path level
- Fuse ball/player/audio information after tracklet level but before path level

From tennis to badminton

- More difficulties moving to shuttlecock tracking
 - Higher speed: up to 400km/hour
 - Different dynamics
 - Smaller court => relatively larger players => more occlusion
 - Smaller court and higher speed => more abrupt motion change
- Preliminary tracking results
 - Worse than tennis tracking results
 - All parameters optimised for tennis

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From tennis to badminton



Future work

- What is the ultimate goal of ball/shuttlecock tracking?
 - Are we after the trajectory, or the key events?
 - Design of the tracker depends very much on this goal
- Early fusion of all available channels
- Sequential processing accumulates error
 - More interaction between modules, low/high levels
 - Run each module multiple times until convergence